Odyssey: Comet Nucleus Orbiter; A Discovery 2000 Proposal

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Odyssey will be NASA's first comet nucleus orbiter mission. The spacecraft will be launched in June 2006 on a Delta 2925 expendable vehicle and will use solar electric propulsion to rendezvous with periodic Comet Kopff in September 2009. Kopff is one of the most active short-period comets known, with a gas production near perihelion of 5×10^{28} molecules/sec and an estimated nucleus diameter of ~3.6 km. En route to Kopff, Odyssey will fly by the C-type asteroid 24 Themis, the largest asteroid ever encountered by a planetary spacecraft (d $\approx$ 215 km). Odyssey's scientific payload includes narrow and wide angle CCD cameras, an IR imaging radiometer, a gas chromatograph/mass spectrometer, a dust compositional analyzer, and a dust counter and accumulation sensors. The spacecraft will initially perform slow flybys of the active Kopff nucleus at distances between 500 and 100 km, and will then be placed in orbit around the nucleus at altitudes between 200 and 50 km. The *in situ* instruments will collect and analyze gas and dust in the cometary coma, providing elemental, molecular, isotopic, and mineralogic measurements of the cosmochemical record locked in comets of the origin of our solar system and the origin of life. The narrow angle camera will map the entire nucleus surface at a resolution of 1 m/pixel, providing detailed images of the nucleus topography and its change with time. The thermal imager will do the same at 21 m/pixel, providing unprecedented data on the energy balance at the surface of the cometary nucleus, key to understanding how the comet works. Odyssey will study Comet Kopff for 9 months. Extended mission options include: 1) higher resolution mapping at even lower altitudes, and 2) touch-down of the spacecraft on the nucleus surface.

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